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# Biology and Management of Soybean Diseases Increasing in Importance to Iowa Soybean Production

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## **BIOLOGY AND MANAGEMENT OF SOYBEAN DISEASES INCREASING IN IMPORTANCE TO IOWA SOYBEAN PRODUCTION**

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Different plant pathogens have different environmental requirements for growth and survival. As the weather changes from season to season, so does the prevalence of certain pathogens. This natural cycle results in a changing disease picture in production systems and poses a challenge for soybean producers. Changes in farming technology, farming practices, soybean germplasm, and climate often are followed by changes in plant diseases. In the last ten years, growers in Iowa as well as rest of the north-central region of the U.S. have witnessed dramatic changes in soybean diseases including observed epidemics of some new or re-emerging diseases. For example, soybean brown stem rot used to be called a billion dollar disease in the 80's, this cool season disease occurred frequently before the 1990's, but hasn't reached epidemic levels in Iowa since the 1993 epidemic. With the adoption of narrow row soybeans, white mold, also a cool season disease, increasingly became epidemic in northern and central Iowa with the severest damage in 1996.

In recent years, winter temperatures and growing seasons have been even warmer than the years of 1993 and 1996 when last epidemics of white mold and BSR occurred. While occurrence of these two diseases have been minimal, three groups of relatively new diseases to Iowa soybean growers have gradually emerged as a problem to production. These diseases are favored by warmer weather conditions and they are 1) diseases caused by *Phomopsis*/*Diaporthe* and 2) diseases that cause seed quality problems, and 3) sudden death syndrome. In this chapter, I will discuss the biology and management of the first two groups of diseases. Sudden death syndrome (SDS) will not be discussed in this chapter because of length considerations. Information on SDS can be found in other extension publications.

### **Diseases caused by *Phomopsis*/*Diaporthe* fungi**

*Phomopsis* is a common fungus in soybean production. The name *Phomopsis* refers to one part of the life cycle of this fungus (non-reproductive stage). In the reproductive stage when ascospores are produced, the fungus is called *Diaporthe*. Several closely related species of *Phomopsis*/*Diaporthe* have been found to attack soybeans and cause different diseases, such as *Phomopsis* seed decay, top-dieback, and northern stem canker. Over the last two years, soybean top die back, also called tip blight, emerged as a production concern in eastern and central Iowa. Severe damage by northern stem canker was reported in South Dakota and Wisconsin this past season.

### *Phomopsis Seed Decay*

Phomopsis/Diaporthe is widely present in fields where soybean has been grown. The fungi are also seedborne and can be introduced into production fields when infected seeds are planted. Therefore, there are two possible sources of inoculum, infected seeds and infested debris from previous soybean crops. The potential damage of using severely infected seeds is through risk of seedling damping-off. If inoculum are in the form of spores produced from soybean debris of previous growing seasons, the spores can infect young seedlings and symptoms can be found before the first trifoliate stage (V1). Infected seedlings are first seen to have dark lesions on the cotyledons. In severe cases, more than 90% of the seedlings can have infected cotyledons. If the infected cotyledons drop, no subsequent seedling damping-off occurs. The fungus then remains in the plants without showing symptoms unless plants become stressed in later, reproductive stages. The fungi infect pods and seeds which often are small and shriveled at harvest. Seed decay may occur during storage and such seeds have a reduced germination rate.

### *Top dieback*

For top dieback, the symptoms occur after the middle of August. Initial symptoms of top dieback are yellowing and death of leaves in the upper portion of the plant canopy followed by discoloration of internodes. Plants die prematurely when the disease is severe. Infected seeds often are small and shriveled on these plants. Plants under stress will have more severe symptoms. A preliminary study has indicated that symptoms of this disease may invoke nutrient deficiencies in soybeans.

### *Stem canker*

The first symptoms of northern stem canker also become visible in August. The fungus causing this disease is referred to as Diaporthe. The same fungus causing top dieback may also cause northern stem canker. The disease is different from top dieback in that lower nodes of infected plants have lesions which do not have well defined edges. On these lesions, the typical Phomopsis symptoms are present, such as black pycnidia arranged in conspicuous lines. Infected plants, noticeable because of leaf necrosis at the top of the plant, may be scattered or found in patches within the fields. A scattered pattern of diseased plants indicates that inoculum is from infested seeds. A patchy distribution of diseased plants suggests that inoculum is from infested residue and that this disease has been in the fields for years.

### *Management options*

Because the same group of fungi cause the above mentioned disease problems, management options are similar for all these diseases. Scouting may start at seedling stages if excessive rainfall occurs. If you find fields with high levels of infection on the cotyledons, keep an eye on these fields in mid-August for foliar symptoms. Prevention of the introduction of the fungi into a field is not a recommendation as the fungus is everywhere, although one should avoid using infected seed to reduce the risk of damping-off. Try to avoid practices which will increase stress on soybean as stress enhances top dieback. Because the pathogen survives in infested soybean residues, use tillage practices which bury infested soybean residues if top dieback and northern stem canker are severe.

## **Diseases causing soybean quality problems**

Severe problems of discolored soybean seeds were first noticed by growers in the spring of 1996 in southern Iowa. The problem had not received sufficient attention until it became widespread in 1998 and 1999 when weather conditions during the growing seasons favored the occurrence of these diseases. Many factors can cause seed coat discoloration or affect seed quality. Disease is only one of them. Physiological stress can also result in discoloration similar to that caused by soybean mosaic virus. Further, both fungal and viral diseases can cause seed discoloration, which further complicates the identification of the causal agent.

### *Viral diseases*

Two diseases, soybean mosaic virus and bean pod mottle virus, that cause seed quality problems in Iowa have been observed to be increasing. Viral diseases have traditionally been production problems in warmer regions and have not been a production concern in Iowa until the last two years. Reasons for the sudden occurrence of such viral diseases in Iowa are yet to be determined, but it is known that warmer winters over the last two years have been favorable to the diseases.

Soybean mosaic virus (SMV) is well known by many growers. The disease was prevalent in some areas of southern Iowa last year. In Iowa, the initial source of the disease in a production field is likely to be from infected soybean seeds. Aphids which spread the virus during a growing season cannot overwinter in Iowa. The insect must migrate to Iowa by air currents during the growing season. In a soybean field, aphids transmit the virus to new plants after feeding on infected plants which start from infected seed. Aphids can migrate from one field to another during a growing season. SMV infected plants have symptoms similar to some herbicide injuries and can be misidentified. Infection by this disease often will not cause yield loss in Iowa. The damage is to seed quality. Seeds from plants infected by SMV sometimes have discolored or mottled seed coats. Depending on the hilum color, discoloration of soybean seeds infected by SMV varies. However, mottled seed coats can be caused by other organisms. There is no resistance information available for soybeans grown in Iowa. The best and also the only available management option is using seed free of SMV.

Bean pod mottle virus (BPMV) is a relatively new disease to Iowa. The disease has become prevalent, however, in western and central Iowa. Like SMV, this virus is seedborne and the initial source of infection can be from virus infected seed. Unlike SMV, BPMV is transmitted by the bean leaf beetle during the growing season. It is not clear, however, if the vector of this virus (bean leaf beetle) can carry the virus overwinter and be a source of initial infection. The rate at which an infected seed becomes an infected plant is low, which means that only a very small portion of infected seeds develop into diseased plants and the rest will be disease-free. The level of bean leaf beetle feeding is correlated with severity of BPMV. Seed from infected plants may be discolored with gray seed coat. Like SMV, no resistance information is available. In other states, use of insecticides to control bean leaf beetles has been recommended for the management of this disease. The control efficacy may not be consistent because the migrating nature of bean leaf beetles.



## Fungal diseases

Two fungal diseases causing seed quality problems in Iowa have also become prevalent in recent years. The first one has been mentioned above, seed decay caused by *Phomopsis*/*Diaporthe* complex. The second is *Cercospora* leaf spot which causes purple seed stain. *Cercospora* leaf spot is a seedborne disease caused by the fungus *Cercospora kikuchii*. The fungus survives in infested soybean residue in the absence of soybean crops. In a warm growing season and under extended periods of high humidity, it produces abundant spores from infested residues that remain on the soil surface. Spores of the pathogen spread by wind and splashing rain to leaves. In Iowa, the leaf symptoms of this disease often appear after the middle of August and last until soybean maturity. The disease is more severe in early maturing varieties. In infested fields, diseased leaves are first observed at the top of the plants, the top of the leaves often turning a light purple color. At harvest, seeds from plants severely infected by *Cercospora* have purple seed coats. The disease is also called purple seed stain. To **manage this disease**, avoid using infected seed and use tillage practices which reduce the amount of infested soybean residue. Foliar application of fungicides, such as Topsin, can reduce the disease.

**Table 1. Prevalent soybean diseases that caused seed quality problems in Iowa**

Name of disease	Causal agent	Means of dispersal	Reported damage areas in Iowa	Management recommendations
Phomopsis seed decay	Fungi: <i>Phomopsis</i> species	seeds, splashing rain	eastern, central, and western Iowa	seed treatment, use healthy seed, use tillage
Top dieback	Fungi: <i>Phomopsis</i> / <i>Diaporthe</i> species	seeds, splashing rain	eastern Iowa	use healthy seed, use tillage, reduce stress
Northern stem canker (minor seed problem)	Fungi: <i>Diaporthe</i> species	seeds, splashing rain	eastern, central, and western Iowa	use healthy seed, use tillage
Purple seed stain	Fungus: <i>Cercospora kikuchii</i>	seeds, splashing rain	all regions in Iowa	use healthy seed, use tillage, use fungicide in growing season
Soybean mosaic virus (SMV)	Virus: Soybean mosaic virus	aphids	west, central, southeast Iowa	use seed free of SMV
Bean pod mottle virus (BPMV)	Virus: Bean pod mottle virus	bean leaf beetle	west, central, southeast Iowa	use seed free of BPMV, control bean leaf beetle

## Summary

Because many factors cause seed discoloration, correct identification is essential to effectively reduce the problem. For instance, insect damage can also cause seed coat discoloration and has often been mistaken for diseases. Bean leaf beetle damage in soybean pods can result in seed discoloration similar to discoloration by pathogen infections. The insect damage also enhances some fungal diseases, reducing seed quality. For accurate disease identification, seed testing is needed. The Iowa State University Seed Science Center provides seed testing for a reasonable fee. The use of pathogen-infested seeds can increase the spread of a seedborne disease. Growers who want to save soybean seeds for next season are advised to check seed quality before they use them. Table 1 summarizes major points of this chapter.

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